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SOME GEOPHILOUS MEALY-BUGS FROM AUSTRALIA (HOMOPTERA: COCCOIDEA)

BY T. D. A. COCKERELL AND ELMER D. BUEKER

In 1894, *Ripersia maritima* Cockerell was described from specimens found on roots of the grass *Spartina* at Hempstead Harbor, Long Island. It occurred between tide-marks, being submerged at each high tide. It was remarked at the time that it showed a very close resemblance to *R. rumicis* Maskell, found among roots of *Rumex* in New Zealand. Since then, other related species have been described from California (*Ripersiella kelloggi* Ehrhorn and Cockerell) and the Rocky Mountains (*R. leucosoma* Cockerell); while the British *R. halophila* (Hardy), found on the roots of grass and other plants, proves to belong to the same group. This series of mealy-bugs is so distinctive in its characters, and the species are so similar, that it has been set aside as a distinct genus, *Ripersiella* Tinsley, 1899. It is, however, perhaps too close to *Rhizoecus* Künckel, 1878, which has five-jointed antennæ.[1] How does it happen that these coccids, the females of which can crawl only a short distance, are thus spread over the world? The species are different, and there is no reason to suppose that they have been spread by commerce. Are they representatives of a type of enormous antiquity, now surviving in certian localities? Other examples from other groups of coccids can readily be cited, suggesting some occasional mode of distribution no less efficient than the flight of Lepidoptera and Orthoptera. This, we cannot doubt, is transportation by migrating birds. Many of the shore birds, famous for their migrations, nest on the ground. It is comparatively easy for the newly-hatched larvæ of geophilous coccids to wander on to the body of a bird and be carried hundreds of miles in a single night. It is not to be supposed, nor does the evidence suggest, that this is constantly happening. It will suffice to explain the facts of distribution if it occurs at rare intervals, the larvæ still more rarely surviving the journey and finding a means of living at the other end. It is obvious that species thus transported will stand a good chance of survival if they are general feeders, or feed on grass. The specialized coccids with particular host-plants would stand hardly any chance.

[1]Newstead gives a full account of *Rhizoecus terrestris* (Newstead), showing the peculiar antennæ.

The observed facts seem to agree well enough with these suppositions, and it will be interesting to determine how far geophilous or grass-feeding coccids are distributed in remote places or on islands. At the present time the records are quite inadequate. It is not so long ago that practically nothing was known of geophilous mealy-bugs in America, yet we now know that they abound in species and individuals, especially where the nests of the ant *Lasius* are to be found. From the southern hemisphere the records are few and scattered. Green is constantly adding species to the recorded fauna of the western Palæarctic region.

Mrs. Wilmatte P. Cockerell had long collected mealy-bugs under stones in New Mexico and Colorado, finding many new species. Consequently, when in Australia in 1928, she could not resist turning over likely looking stones, and was rewarded by the discovery of the two species now described. These must be referred to well-known genera of the northern hemisphere, as *Pseudococcus hystricosus* and *Trionymus angustus*. The genera of mealy-bugs have been defined in various ways, and are still subject to revision. Newstead (1903) used the following characters:

Adult females active, covered with mealy secretion, not enclosed in ovisac; female antennæ of eight joints..... *Dactylopius* (now *Pseudococcus*).
Adult females enclosed within ovisac at gestation;
antennæ of nine joints..... *Pseudococcus* (now *Phenacoccus*).
Antennæ of six (rarely five or seven) joints..... *Ripersia*.

This appears simple, but the facts of nature are more complex, and the number of antennal joints differs in evidently related species. However, *Phenacoccus* has a denticle on the claw, which is a good diagnostic character. Ferris (1918) adopted a quite different scheme, stressing the importance of the cerarii, or groups of spines and pores, which range from none to twenty-four in different species. From these arise tufts or tassels of wax, so that, even when the cerarii have not been described, their existence can be inferred from the external appearance of the animals. The group with a denticle on the claw and the antennæ eight- or nine-jointed (usually nine) is divided into three genera: *Phenacoccus*, *Puto* (including *Ceroputo*), and *Heterococcus*. With these we are not now concerned. The other series is first separated into *Pseudococcus* (the common mealy-bugs), with more than four pairs of cerarii, and four other genera, with not more than four pairs. Here is perhaps a weak point, as the reduction of the cerarii has probably taken place independently in several series. Morrison (1925), tabulating a series of mealy-bugs, sets forth the true *Pseudococcus* (at least as relates to the six species

included) as having at least one pair of cerarii present on the head between the antennæ. These cephalic cerarii are plainly visible in the Australian *Pseudococcus hystricosus* described below, but are wholly absent from *Trionymus angustus*. Morrison tabulates three species of *Trionymus* in the paper just cited; in *T. sacchari* (Cockerell), from sugar-cane, only the apical cerarian spines are present and these not well developed. In the new *T. danthoniæ* from Stewart Island and in *T. diminutus* (Leonardi) there are no cerarii on the head, but the former has two posterior pairs of cerarii, the latter three or four.

Trionymus, first described under the preoccupied name *Westwoodia*, was characterized by the elongated form of the body and eight-jointed antennæ. The shape of the body seems usually to be related to life on some narrow object, as a stem of grass, though *T. americanus* (Cockerell), which is very slender, occurs in cracks on the trunk of ash trees. The shape of the body and more numerous antennal joints appear to separate it from *Ripersia* but, as Ferris states, the definition and limitation of *Ripersia* are at present uncertain. There can be little doubt that the many species referred to this genus represent, at least in part, a mixture of generic types. The type of the genus (*R. corynephori* Signoret), a species with six-jointed antennæ, is not known to modern workers. The food-plant is a grass of southern Europe. It is probable that we may properly recognize, following current usage, a genus of geophilous mealy-bugs, mostly found with ants, resembling *Trionymus* in many respects, but with fewer antennal joints. But such species as *Ripersia fimbriatula* Cockerell and King will apparently have to be excluded, and it will be necessary to investigate anew the various aberrant species of "*Ripersia*" to determine what should be done with them.

New biological observations are needed. The reported food-plants may not always be correct. It is difficult, when a mealy-bug occurs on roots, or (as is commonly the case) on the under surface of stones, to determine exactly what plant is used for food. Experiments are needed to determine such points, and also to determine how long the newly hatched larvæ can survive without feeding.

The significance of variation in the number of antennal joints may not be the same in all cases. Coccid larvæ in general have six joints, and the number in mealy-bugs commonly increases with maturity. Thus, it may be expected that a species with a maximum of seven joints will show some individuals with six; or one with nine joints, some with eight. But to have only five joints in the adult (as in *Rhizoecus*) is more remarkable and represents a different tendency.

The specimens of *Pseudococcus hystricosus*, though well developed, are probably not mature, and it is probable that individuals with eight-segmented antennæ will be found. This is suggested by the presence of two whorls of hairs on joints two and three. But this is not conclusive at all, since some species with eight segments (as *Pseudococcus walkeri* Newstead) still show two whorls on each of these segments. The general character of the antennæ is much more like that of *Pseudococcus* than *Ripersia*, in spite of the six segments. The species is a very distinct one, remarkable for the densely glandular surface, coarse curved bristles of the antennæ, long beak, stout femora and long bristles at caudal end. Among the described Australian species it seems nearest to *Pseudococcus similans* (Lidgett), found on roots of *Daphne* in Victoria. This is about 4 mm. long, with eight-segmented antennæ, and a fringe of long cotton-like filaments on each side of the body. Lidgett's figures are extremely crude, and Froggatt states that the type is lost.

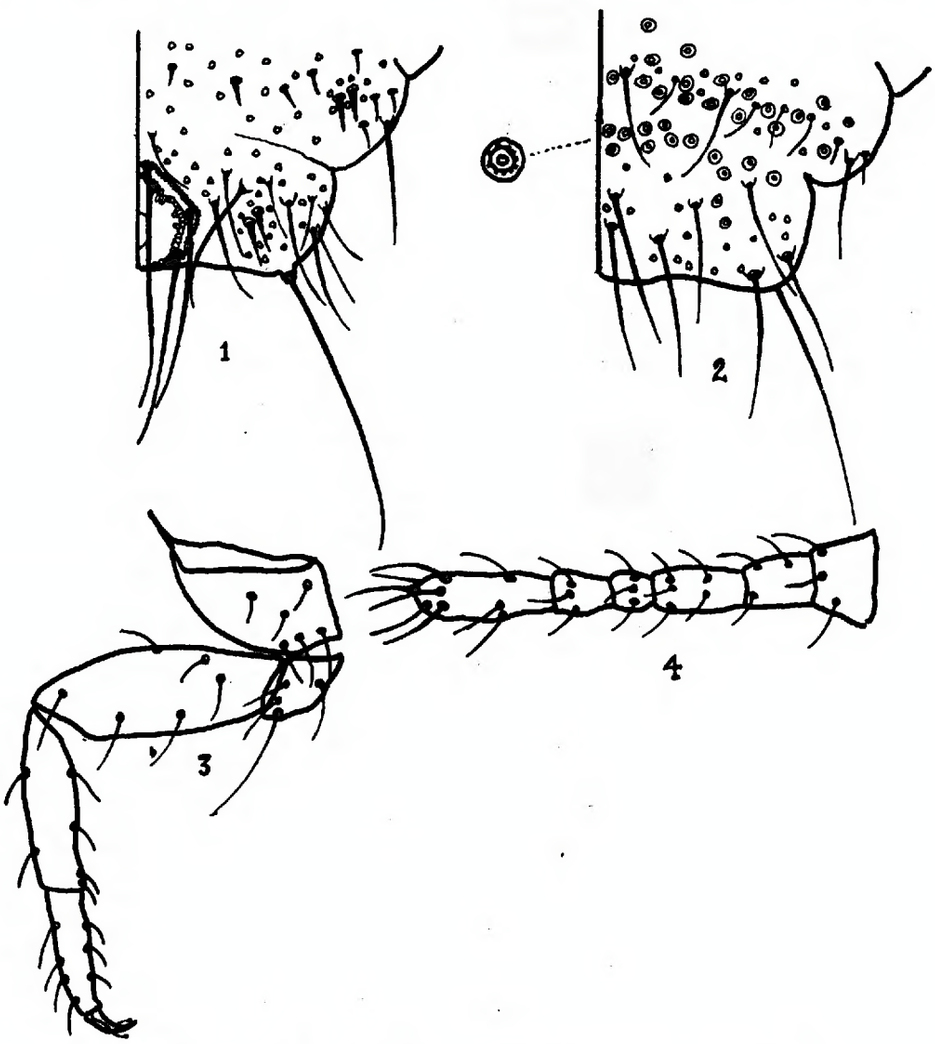
Trionymus angustus is a very small species, but without very striking characters. In shape and general appearance it closely resembles *T. danthoniæ* and *T. diminutus* described by Morrison, but the antennæ are proportionately very much larger than in these species. The antennal segments 3 to 6 are broader than long, and the second, though distinctly longer than broad, is very stout. Thus, the species departs widely from *T. danthoniæ* and comes nearer to *T. diminutus*, in which, however, the third segment is longer than broad. *T. angustus* is also remarkable for the single, long and strong, bristle on each caudal lobe, and the possession of only a single pair of cerarii. In the last character it agrees with certain Californian species, and rather closely approaches *T. distichlii* Ferris, a species with seven-segmented antennæ, of which neither the size nor the shape is given.[1] The cerarian spines are slender, which would make the species run to *T. distichlii* in the table given by Ferris (1918). *T. angustus* and *T. distichlii* are both forms in which the cerarian structures are reduced nearly to a minimum, but whether they reached this condition independently or represent a natural division of the genus it is impossible to say.

Pseudococcus hystricosus, new species

FEMALE (from slide mounts).—Ovate; length 1.5 mm., width 1 mm.; derm quite clear, but with numerous triangular glands scattered over the dorsal and ventral surfaces, also short spines and occasionally long hair; 25–27 large ocular wax-glands

[1]Ferris states that he had *T. distichlii* from La Jolla, determined by Cockerell as *Pseudococcus salinus*. He was aware that this was only a field determination, the material coming from the type-locality of *P. salinus*, and having superficially the same appearance.

on the ventral side of the last abdominal segment immediately posterior to the genital opening, 28–32 on the second segment anterior to the genital opening, sparse on the third and fourth segments; antennæ six-segmented; average lengths of segments examined in microns: (1) 48; (2) 45; (3) 53; (4) 20; (5) 35; (6) 78; formula 6, 3, 1, 2, 5,4; each joint has stout, curved bristles; segments two and three each with two whorls of curved bristles; sixth segment with three whorls of curved bristles and a group of slender straight bristles at the end; legs not unusual and with small stout bristles; the middle leg with measurements given in microns as follows: coxa with



Figs. 1 to 4. *Pseudococcus hystricosus*, new species.

1, dorsal aspect of posterior portion of abdomen of female; 2, ventral aspect of posterior portion of abdomen of female; 3, middle leg of female; 4, antenna of female.

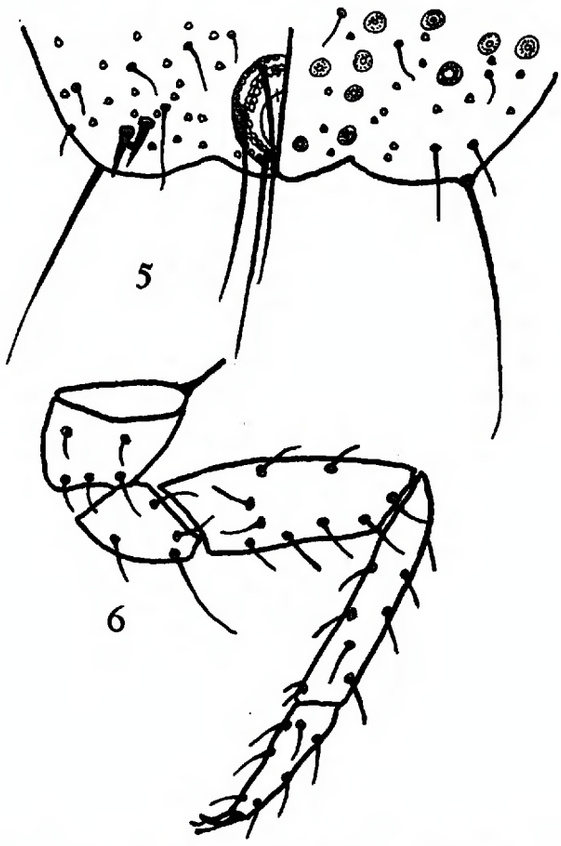
five bristles, length of coxa 60; trochanter with three short bristles and one long bristle 70 in length; length of trochanter 45; femur quite stout, with six short bristles, length of femur 150; tibia with three whorls of bristles, length of tibia 115; tarsus with three whorls of bristles, length of tarsus 80; claw simple, digitules small; beak two-segmented and with numerous stiff bristles at the end, length 150 microns, width 100 microns; caudal bristles stout; anal lobes protruding slightly from the margin of the body, apical seta 270 microns long; anal ring with inner and outer pore-bands, outer band with a tube-like duct in each pore; 6 anal ring-setæ, 125–150 microns in

length; seventeen pairs of cerarii, each cerarius of two conical spines and a few triangular wax-glands; one pair of cerarii lateral of antennæ, one pair between the antennæ.

Jenolan, New South Wales, April 29, 1928, (W. P. Cockerell). The locality is in the vicinity of the famous Jenolan caves. Two specimens on the slide; the holotype is the one with antennæ pointing in different directions (Amer. Mus. No. 28458).

Trionymus angustus, new species

FEMALE (from slide mounts).—Body elongated, narrow, sides subparallel; length when mounted 2 mm., width .6 mm.; derm quite clear with the usual type of triangular wax-glands scattered thinly over the surface; ocular wax-glands very numerous on the ventral side of the abdominal segments; as many as 80–100 glands on the ventral side of the last three segments, gradually becoming fewer on the abdominal



Figs. 5 and 6. *Trionymus angustus,* new species.

5, anal lobe cerarius and anal ring of adult female (left), and ventral view of anal lobe (right); 6, middle leg of adult female.

segments toward the anterior end; antennæ eight-segmented; average lengths of segments examined in microns: (1) 45; (2) 47; (3) 23; (4) 20; (5) 30; (6) 22; (7) 31; (8) 70. The middle leg with the measurements given in microns is described as follows: coxa with five bristles, total length of coxa 65; trochanter with three short bristles and one very long bristle of about 70 microns, length of trochanter 40; femur with nine bristles, length of femur 180; tibia with three whorls of hairs, length of tibia 150; tarsus with three whorls of hairs; length 75; claw normal with two slender digitules which project slightly beyond the claw and have a medium-sized knob on

each; legs not unusual, all of them with stout bristles; beak or labium about as broad as long and forming an equilateral triangle, two-segmented; one pair of cerarii which are located on anal lobes; each cerarius composed of two slender spines and a few triangular wax-glands; anal ring with inner and outer pore-bands, outer pore-band with an elongated duct in each pore; 6 anal ring-setæ, 75–80 microns in length; anal lobes slightly protruding, apical seta of each lobe 120–130 microns long.

Jennings, New South Wales, April 25, 1928, (W. P. Cockerell). Two specimens found under a stone in an open grassy field. The holotype is the one with both antennæ perfect (Amer. Mus. No. 28459).

The types of both species are in The American Museum of Natural History.

Because of the eight-segmented antennæ and the relative lengths of tibia and tarsus, this is, no doubt, a mature form.